

SECTION 3410 - MANHOLES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

Provide all labor, materials, equipment and services required to furnish and install all manholes and appurtenances shown on the drawings and/or specified herein.

1.2 SUBMITTALS:

- A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the ENGINEER for review before ordering. Comply with provisions of Section 1010.
- B. At the time of submission, the CONTRACTOR shall, in writing, call ENGINEER's attention to any deviations that the submittals may have from the requirements of the ENGINEER's Contract drawings and specifications.

PART 2 - PRODUCTS

2.1 MANHOLES:

Manholes of the form and dimensions shown on the drawings shall be constructed of ASTM C 478 precast reinforced concrete manhole sections erected on 4,000-psi one-piece precast concrete integral foundation/bases. Cast-in-place sections and foundations are subject to the OWNER'S review. The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the ENGINEER.

A. Standard Manholes:

Standard manholes shall be six feet to twenty-five feet in depth, measured from the top of the cover frame to the invert of the outlet. The top section shall be an eccentric cone type as shown on the drawings.

B. Manholes with Slab Tops (Shallow Manholes):

The shallow manholes shall be less than six (6) feet in depth, measured from the top of the cover frame to the invert of the outlet. The top section shall be a flat top style as shown on the drawings.

C. Concrete Manhole Sections:

Precast concrete manhole sections (barrels/risers) shall conform to ASTM C 478.

D. Precast Concrete Eccentric Cones:

Precast concrete eccentric cones shall be of the size and shape shown on the drawings and shall conform to ASTM C 478.

E. Precast Manhole Section Joints:

Precast manhole section joints shall be formed entirely of concrete employing a round, wedge shaped profile gasket, Press Seal Type TP or equal, and when assembled shall be self-centering and make a uniform watertight joint conforming to ASTM C 443. The joint shall also be sealed with a bituminous mastic joint sealing compound such as Concrete Sealants, Inc. "Con Seal", or equal.

F. Manhole Bottom Sections:

Manhole bottom sections shall be precast concrete conforming to ASTM C478. Inverts shall be

formed as an integral part of the precast bottom and constructed as shown on the Contract drawings and shall have a smooth finish. Preformed manhole bases will be allowed, if spaces are filled with the appropriate sealer. Where there are changes in the direction of the sewer or entering branches to the manholes, the centerline of the invert shall have a true curve of as large a radius as the size of the manhole will permit. A minimum fall of 0.10 foot shall be provided through all manholes. Tops of manhole benches shall have broom finish.

G. Manhole Steps:

1. Plastic Steps - Plastic manhole steps shall be press fit steps made of polypropylene plastic over ½" steel reinforcing. Manhole steps shall be PS1-PF manufactured by MA Industries, Peachtree City, Georgia; ML-10 manufactured by American Step Company, Inc., Griffin, Georgia; or equal. Steps shall be driven into specially sized holes cast or drilled into the manhole section. Cast holes shall be formed in the manhole section using an insert plug which is removed upon curing. Seal or grout must be provided if the step holes protrude completely through the manhole wall.
2. Whenever possible, steps shall not be placed directly above the manhole flow channel. Steps should be located above the largest bench area in the manhole base. Step spacing shall be 12" minimum and 16" maximum. Steps shall be equally spaced, the entire depth of the manhole.

H. Manhole Frames and Covers: Manhole frames and covers shall be gray iron casting of the heavy-duty pattern with four vent holes. The cover and seat shall have machined bearing surfaces to prevent rocking and rattling and a concealed pickhole. Tops of covers shall be flush with ring edge of frames. Covers shall have the word "SEWER" cast on them in large letters.

1. Standard Manhole Frames and Covers: Standard manhole frames and covers shall be Neenah R-1767, East Jordan 1600, or equal, unless otherwise specified or indicated on the plans.
2. Manhole Frames Above Grade: Where manhole covers are above finished grade or where shown on the plans, manhole frames shall be bolted down through the anchor base flange to the cone section with four 7/8" x 9" stainless steel anchor bolts.
3. Locking Manhole Frames: Where shown on the plans or required by the ENGINEER (typically in areas with a high potential for vandalism such as within off-highway easements), Neenah R-1926-B with Type J-"T" Handle Bar Lock, East Jordan 2045 with Type 5 "T" Handle Bar Lock, or equal, manhole covers shall be used and shall be bolted down through the anchor base flange to the cone section with four 7/8" x 9" stainless steel anchor bolts.
4. Watertight Manhole Frames and Covers: Where manhole covers are located below the 100-year flood elevation or in drainage ways, or where otherwise indicated on the plans, the manhole frames and covers shall be of heavy duty, watertight type with gasket seal and bolted lid with stainless steel bolts. The lid shall have a concealed pickhole. The manhole frame shall be anchored through the anchor base flange to the manhole cone section with four 7/8" x 9" stainless steel anchor bolts. Watertight manhole frames and covers shall be Neenah R-1916-F, East Jordan 1040-PT, or equal.

I. Manhole Grade Adjustment Rings:

All grade adjustments of manhole frame and cover assemblies shall be completed utilizing reinforced concrete grade rings or injection molded High Density Polyethylene (HDPE) adjustment rings as manufactured by Ladtech, Inc. or approved equal. Each new manhole shall have a total height of adjustment rings between 8 and 18 inches, unless otherwise directed by the ENGINEER.

1. Reinforced Concrete Grade Adjustment Rings:
 - a. Precast reinforced concrete grade adjustment rings shall conform to ASTM C 478 and shall be free from cracks, voids, and other defects.

- b. The adjustment rings shall be tested to assure compliance with impact and loading requirements per AASHTO's Standard Specification for Highway Bridges.
- c. Installation shall be according to manufacturer's recommendations and the following procedure.
 - i. Clean the concrete cone or top slab with a whisk broom or chisel to assure a flat seating surface free of rocks, gravel, blacktop, protruding concrete, frozen or other debris.
 - ii. Measure the distance from the cone or top slab to the projected finish grade and deduct for the cover frame. Determine the net buildup of rings necessary to come within 1/4" of grade with the cover frame in place.
 - iii. Determine the best ring height combination to attain necessary adjustment.
 - iv. If the cone or top slab is too badly chipped or damaged to attain a good seal, the damaged component must be replaced. Apply two strips of Conseal or approved equal to the cone or top slab around the entire circumference, overlapping the ends.
 - v. Place the first ring down onto the cone or top slab.
 - vi. Apply two strips of Conseal or approved equal to the top of the first grade ring around the entire circumference, overlapping the ends.
 - vii. Place the second ring down onto the first ring.
 - viii. Continue the assembly per steps 6 and 7 for each adjustment ring being used. A maximum height of 18" is permitted for adjustment rings.
 - ix. Prior to setting the cover frame in place, apply two strips of Conseal or approved equal to the last ring around the entire circumference, overlapping the ends.
 - x. Set the cover frame in place, centered on the top ring.
 - xi. If the manhole vacuum test fails, then the CONTRACTOR shall seal the grade rings with an approved butyl sealant.

1. High Density Polyethylene Grade Adjustment Rings:

- a. Plastic adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM D 1248 (Standard Specification for Polyethylene Plastic Molding and Extrusion Materials). Material properties shall be tested and qualified for usage per the ASTM Test Methods reference in ASTM D 1248. Recycled material meeting the above requirement may be used. HDPE grade rings shall not be used in traffic areas.
- b. Plastic adjustment rings shall be manufactured utilizing the injection molding process as defined by the Society of Plastic Engineers (SPE).
- c. The adjustment rings shall be tested to assure compliance with impact and loading requirements per AASHTO's Standard Specification for Highway Bridges.
- d. Installation shall be according to manufacturer's recommendations and the following procedure.
 - i. Clean the concrete cone or top slab with a whisk broom or chisel to assure a flat seating surface free of rocks, gravel, blacktop, protruding concrete, frozen or other debris.
 - ii. Measure the distance from the cone or top slab to the projected finish grade and deduct for the cover frame. Determine the net buildup of rings necessary to come within 1/4" of grade with the cover frame in place.
 - iii. Determine the best ring height combination to attain necessary adjustment. Molded slope rings shall be used to match grades of paved surfaces that

are not flat. Molded slope rings shall be used to accommodate other grades that are not flat only when directed by the ENGINEER.

- iv. Dry stack rings on cone. Index any slope rings as necessary. Place cover frame casting on top of the assembly and verify height and slope match.
- v. Mark the entire stack with a vertical line and disassemble.
- vi. If the cone or top slab is too badly chipped or damaged to attain a good seal, the damaged component must be replaced. Apply a 3/16 to 1/4 inch bead of approved butyl sealant to the cone or top slab (A double bead of sealant should be used if surface irregularities are present).
- vii. Place the first ring down onto the cone or top slab with the male lip into the opening, aligning the vertical line.
- viii. Apply a 3/16 to 1/4 inch bead of approved butyl sealant on the bottom of the next ring, as close to the male lip as possible around the entire 360 degrees of the ring.
- ix. Place the second ring down onto the first ring with the male lip interlocking into the center, aligning the vertical line.
- x. Continue the assembly per steps 8 and 9 for each adjustment ring being used. A maximum height of 18" is permitted for adjustment rings.
- xi. Prior to setting the cover frame in place, apply a 3/16 to 1/4 inch bead of approved butyl sealant on top of the last ring. Apply the sealant in a location to contact the cover frame the full 360 degrees.
- xii. Set the cover frame in place, centered on the top ring.
- xiii. If the manhole vacuum test fails, then the CONTRACTOR shall seal the grade rings with an approved butyl sealant.

- e. All HDPE adjustment rings shall be covered by a full two-year warranty that warrants the adjustment rings for two years from the date of installation against defects in materials. Any defective adjustment rings shall be replaced at no cost to the OWNER.

J. Precast Drop Manholes:

Precast drop manholes shall always be provided for sanitary sewers where indicated on the plans or as directed by the ENGINEER. The manholes shall be manufactured the same as the manholes described hereinabove with the exception that the outside drop section of pipe is formed as an integral part of the manhole with the drop pipe being supported by concrete extending from the top of the stack to the base of the manhole.

K. Pipe Connections Into Manholes:

Sewer pipe to manhole connections on all sanitary sewers shall be flexible and watertight. Sewer pipe shall be sealed in the manhole section pipe openings with a resilient connector meeting the requirements of ASTM C923. The connection may be any of the following types:

1. Rubber sleeve with stainless steel banding (field installed/cored opening)
 - a. KOR-N-SEAL as manufactured by Pollution Control Systems, Inc.
 - b. PSX Direct Drive as manufactured by Press-Seal Gasket Corporation
 - c. Or Equal
2. Rubber sleeve with stainless steel banding (cast in manhole opening)
 - a. Lock Joint Flexible Manhole Sleeve as manufactured by Chardon Rubber Company.
 - b. Cast-a-seal as manufactured by Press-Seal Gasket Corporation
 - c. Z-Lok as manufactured by A-Lok Products, Inc.
 - d. Or Equal

3. Rubber gasket compression (cast in manhole opening)

- a. Dura-Seal III as manufactured by Blackthorn, Inc.
- b. Econoseal as manufactured by Press-Seal Gasket Corporation
- c. A-lok X-cel as manufactured by A-Lok Products, Inc.
- d. Or Equal

Resilient connector shall be cast integrally into the wall of the manhole section at time of manufacture, or, shall be installed by mechanical means in openings cut into manhole wall per ASTM C 923.

To maintain flexibility in the connection, a space shall be left between the end of the pipe inside the manhole and the concrete channel; this space shall be filled with a joint compound. However, there shall be no mortar placed around the connector on the outside of the manhole and no mortar shall be placed around the top half of the connector on the inside of the manhole when completing the invert work. Also, sanitary sewer pipe shall not protrude into the trough of the manhole (all pipe shall be flush with the manhole).

L. Gravity Sewer Drops Into Existing Manholes (Retrofit) and Force Main Drops Into Manholes:

Drops into existing manholes shall be constructed by core drilling into the wall of the manhole. Pipe connections into the manhole shall meet the requirements of Paragraph 2.1.K. The stack pipe shall be SDR 26 PVC pipe for gravity sewer inlets and epoxy coated Pressure Class 350 ductile iron pipe for force main inlets. Stack pipe shall be laid inside the manhole and anchored to the side with stainless steel straps. The tee inside the manhole shall be joined to the inlet pipe and the stack pipe with gasketed joints for PVC pipe and flanged joints for ductile iron pipe. A flanged 45-degree bend shall be installed at the bottom of the stack pipe and aimed toward the downstream sewer for force main discharges.

M. Installation of Manhole Around Existing Sewer Pipe:

Should a manhole need to be installed around an existing sewer, the existing sewer pipe must first be exposed and an invert constructed under the pipe. The excavation must be kept free of water while the manhole is being constructed. Inverts may be formed by pouring the concrete invert (3,000 psi concrete), and cutting out the top half of the pipe. A precast manhole section, with U-shaped cutouts for the pipe, can then be installed over the existing pipe. The voids of the cutout must then be filled with hydraulic cement as specified in Section 3920.2.1.C, D and E. The top sections of the manhole would be constructed per the standard manhole specification. Cast-in-place manholes will also be permitted for installation around existing sewers. The sanitary sewer pipe shall not protrude into the trough of the manhole (all pipe shall be flush with the manhole).

N. All manholes shall be completely sealed and watertight (except covers that are not required to be watertight). All visible leaks in manholes observed during construction, inspection, or testing shall be repaired. Any identifiable leaks observed during the vacuum test shall also be repaired, even if the vacuum test passes. Cementitious grout products are not acceptable products for repair. Use an approved flexible sealant.

O. Bedding and backfill for manholes shall be in accordance with Section 3730 of these specifications.

P. Allowable Pipe Sizes and Interior Angles for Various Size Manholes:

MANHOLE DIMENSIONS

MH INSIDE DIAM.	MAXIMUM PIPE SIZE	MINIMUM INTERIOR ANGLE
48"	24"	104°
60"	36"	116°
72"	42"	108°
84"	60"	135°

PART 3 - BASIS OF PAYMENT

Payment for standard manholes with standard frames and covers as described in the detailed specifications, will be made at the Contract unit price each, complete in place, which price will include the manhole, complete with bedding, precast concrete base riser and cone (or flat slab top) sections, grade adjustment rings, cast iron frame and cover, inverts, steps, excavation (including rock), backfilling and surface restoration (except pavement replacement). Payment for other speciality manholes will be made at the contract unit price each, complete in place, which price will include the manhole, complete with bedding, precast concrete base riser and cone (or flat slab top) sections, grade adjustment rings, cast iron frame and cover, inverts, steps, excavation (including rock), backfilling and surface restoration (except pavement replacement).

END OF SECTION